Patent

File No. 12994

AEROSOL PROPELLED SCENT GENERATING SELF-COOLING BEVERAGE CONTAINER WITH PHASE LOCKED PROPELLANT MIXTURES AND PROCESS OF MANUFACTURING THE SAME.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to the field of food and beverage containers and to processes for manufacturing such containers with aerosol propellant mixtures and scents of various kinds. More specifically the present invention relates to a scent generating self-cooling beverage container apparatus containing a beverage or other food product, a method of propelling a scent by means of an aerosol propellant mixture, which then cools said food products, and to methods of assembling and operating the apparatus. The terms "beverage," "food," "food products" and "container contents" are considered as equivalent for the purposes of this application and used interchangeably.

2. Description of the Prior Art:

There have previously been self-cooling containers for cooling the contents such as food or beverages that include flexible and deformable receptacles with widely spaced apart, rigid receptacle walls, and methods of manufacturing these containers. These prior art do not address the real issues of manufacturing and beverage plant operations that are crucial for the success of a self-cooling beverage container program. All prior art designs fail when subjected to the immense

pressures (about 45 - 60 psi) of the carbonated filling process and fail to maintain the container column strength. The sudden blast of carbon-dioxide inside a container during filling, can destroy any thin-walled internal container, and collapse its walls so that the functionality of the apparatus will be impaired. Also, the sudden collapse of such internal containers, can cause the can itself to loose column strength, and collapse under the clamping force that is applied for sealing the can during filling. Many trials and designs were done to obtain the present configuration of the disclosed receptacle of this invention. No prior art teaches how to manufacture a self-cooling beverage plastic bottle as a single unified unit that will conform to the standards of the beverage industry.

For example when an internal receptacle is used as a pressurized gas storage receptacle, the beverage filler head pressurizes its external walls and crushes the receptacle, since such receptacles are generally made from thin walled materials for rapid heat transfer, they can be easily crushed by external pressure and cannot survive the forces of the high speed manufacturing process. Thus, failure of the internal receptacle, can also result in the sudden collapse of the container walls. Even with prior designs of co-seamed internal receptacles such as that described in U.S. Patent Number 6,065,300 to the present inventor the problem was still not solved. Also, the high speed beverage plants require high speed compatible operations for manufacture of an online self-cooling beverage container. For example, prior art designs do not address easy insertion, self-aligning of the receptacle with the container and so on. Further, most prior art relies on a separate unintegrated manufacturing process for the attachment of the receptacle to the container. The prior art differs from the current disclosed invention in that they all require complicated valving for activation of the cooling process. Most use rubber seals, gaskets and expensive attachment means. The present invention does not require a special valving system. Just two parts that form the receptacle and the

attachment means to the can suffice to form a self acting valve based on the opening of the container for consumption. U.S. Patent Number 6581,401,B1 invented by the present inventor shows a technology based on phase locked refrigerants that are only used to cool a beverage container such as a can or bottle. This invention is an improvement over said patent and discloses a novel technology for bottles also with the additional aspect of using aerosol propellant mixtures that will propel a scent from the container. The reason for the improvement is that no other technology addresses the repugnant smells generated by various gas mixtures, and further this invention calls for the use of aerosol propellant mixtures specially formulated with a scent such as a coca-cola scent, fruity smells or the smell of fresh flowers for example.

SUMMARY OF THE INVENTION

The present invention accomplishes the above-stated objectives, as well as others, as may be determined by a fair reading and interpretation of the entire specification.

For the preferred of several possible embodiments, the apparatus includes a conventional beverage or food container such as a metal or plastic container for containing a product to be consumed. For metal containers, the container has a conventional unified domed bottom wall, and a cylindrical side container wall terminating in an upper container sealing rim. A container sealing lid is also provided for sealing off the container contents inside the container. A hole passes through the center of the domed bottom wall of the container making fluid communication between the inside and the outside of the container. The apparatus further comprises a thin walled plastic or metal receptacle with substantially the shape of a small plastic or metal bottle with a bottle neck. With the said receptacle oriented so that it sits on a bottom wall rim and with the open bottle neck

facing an upwardly direction, the receptacle comprises a substantially horizontal round top wall with an upward facing surface and a downward facing surface. From the center of the upward facing surface is joined a short smaller diameter cylindrical receptacle neck protrusion which terminates with a thin receptacle open neck round flange. Said receptacle open neck flange having a slightly larger diameter than the cylindrical receptacle neck. The receptacle top wall has a diameter that is greater than the diameter of the receptacle open neck protrusion. The top wall and the receptacle neck form a continuous unified wall of the receptacle with the receptacle open neck also passing through the receptacle top wall as an entry way for ingredients that are to be stored inside the receptacle. A receptacle side wall sealingly joins the receptacle top wall protruding in the downward direction to sealingly join a substantially round receptacle bottom wall. Thus, the receptacle walls are all joined together to form continuous bottle with an open neck. The receptacle bottom wall is designed to be slightly flexible and to flex up and down the axis of the receptacle, so as to increase the overall length of the receptacle when the pressure acting inside the receptacle walls is greater than the pressure acting outside the receptacle walls. In general the walls of the receptacle are flexible and thin relative to its size. The receptacle is designed to be handled easily for manufacturing the self-cooling container so that the processes that would be encountered during the manufacturing would be easily accomplished because of the way the receptacle is designed and works. The receptacle is designed to store a liquified aerosol propellants or a matrix held aerosol propellants and smell ingredients such as a combination of C02 and carbon atoms, at a minimal pressure difference across its walls by means of equilibration with beverage pressure, and when the aerosol propellant pressure acting inside the receptacle walls equilibrates with beverage pressure acting outside the receptacle walls. The preferred aerosol propellant is a mixture of hydrocarbons

and flame retarding chemicals such as 134a and FM 200 or other flame retarders that may be appropriate. The aerosol propellants may be designed as a slurry of an activated carbon matrix with CO2 gas trapped inside the matrix. The receptacle sealed bottom wall is flexible. A substantially conical valve seat protrusion protrudes outwardly in a downward direction from the center of the receptacle bottom wall. The inside wall of the valve seat recess is designed to sealingly mate with the sealing cone of a substantially tubular stem valve, so that liquified aerosol propellant and scent chemicals contained inside the receptacle will not boil and escape from within the receptacle when the pressure outside the receptacle is greater than the pressure of the aerosol propellant gas contained inside the receptacle. Advantageously, the receptacle valve seat recess will not form a seal with the stem valve sealing cone if the outside pressure acting on the receptacle walls is less than the liquified aerosol propellant pressure acting on inside walls of the receptacle.

The apparatus further comprises a stem valve for mating with the receptacle. The stem valve is a substantially tubular valve with a sealing cup flange attached near one end of the stem valve. The sealing cup flange is shaped like a shallow bowl of a diameter of approximately 1 inch and a depth of about 1/4 inch, for sealing against the bottom wall of the beverage container. A short cylindrical tube of a length of about ½ inches and diameter 3/8 inch protrudes from the outer surface of the sealing cup flange and connects to a conical tube stem valve body of a length of about 3 inches. The dimensions given are only for the sake of comparative clarity of the present invention, and should not be construed as the only possible dimensions for the parts of the apparatus. A short small cylindrical stud protrudes from the inside surface of the sealing cup flange in the opposite direction to the stem valve body. The approximate diameter of the stud is about 1/4 inch, but it could be larger or smaller depending on the size of the beverage container the apparatus is designed for.

A small stem valve hole passes through the entire length of the stem valve. The stem valve hole could be made larger inside the stem valve body, for reasons of ease of manufacturing. However, the hole that passes through the stud must be close to 0.04 inches diameter. Again all of the dimensions sited are examples of one embodiment of the invention. The stem valve conical protrusion is designed to tightly push to form a swage fitting, or to snap into the hole through the domed bottom wall of the beverage container holding the receptacle and stem valve assembly centrally inside the beverage container. The sealing cup flange forms a tight gas seal against the domed bottom wall of the beverage container when the stem valve stud is tightly affixed into the container bottom wall hole.

In one embodiment of the invention, the apparatus is assembled by first affixing the stem valve into the receptacle by passing the stem valve body through the receptacle open neck, so that the receptacle stem valve cylindrical body seals against the receptacle neck cylinder, and the outside surface of the stem valve sealing cup flange sealingly mates to the surface of the receptacle open neck flange. The stem valve cylinder is designed to fit snugly and tightly into the receptacle open neck so that a gas tight plug is formed around the receptacle open neck protrusion. The stem valve is made long enough so that when the stem valve sealing cup flange mates with the receptacle open neck flange, the stem valve sealing cone also sealingly abuts the inside side wall of the receptacle valve seat recess. Thus, when the stem valve sealing cone abuts the inside side wall of the receptacle valve seat recess, pressurized gas cannot escape through the stem valve hole, or through the receptacle open neck protrusion, when the pressure inside the receptacle is less than the pressure outside the receptacle. And when the pressure inside the receptacle is greater than the pressure outside the receptacle the receptacle valve seat recess is expanded and moves away from the stem

valve sealing cone so that pressurized gas can escape through the stem valve hole. Other methods of practicing the invention do not require that the stem valve bottom edge seal the inside wall of the receptacle valve seat recess when the stem valve flange is fully seated on the receptacle open neck flange. It is important that the stem valve sealing cone be close to or actually contact the inside surface of the receptacle valve seat, so that if the pressure inside the receptacle is less than the pressure outside the receptacle, the receptacle bottom wall is deflected inwardly to make contact between the inner surface of the receptacle valve seat recess and the sealing cone of the stem valve to form a gas tight seal that traps any liquified or gaseous aerosol propellant inside the receptacle from escaping to the outside through the stem valve hole.

To manufacture the apparatus, the receptacle is first filled with clean water. The stem valves are then inserted into the receptacle through the receptacle open neck to displace some water and form a seal with the receptacle open neck and the receptacle valve seat recess inside surface. Thus the water is trapped inside the receptacle and cannot pass through the stem valve hole, or the receptacle open neck. The assembly is then inserted into the beverage container, and the stem valve stud is aligned and pushed through the container bottom wall hole. The stem valve stud is made slightly larger in diameter than the diameter of the container bottom wall hole, so that as the stem valve stud pushes through the container bottom wall hole, the stem valve stud forces the container bottom wall hole rim to form a slightly conical depression around the rim forming a thin wall of conical material protruding out of the container. This conical ring of material forms a tight swage fitting that holds the stud firmly in place on the container and so does not allow the assembly to be easily removed from the hole. A snap action may also be used for this attachment. The deforming of the hole into a substantially conical rimed hole, causes the container wall material to bight into

the softer valve stud material and form a hematic seal, and a very tight strangle hold on the valve stud. The stem valve is pushed into the container bottom hole until the stem valve sealing cup flange makes a tight cup seal between the stem valve and the container bottom wall. The assembly is then transported to a beverage filling plant, where the apparatus is filled with beverage product under carbonation pressure.

During the beverage filling process, a filler head is sealed against the beverage container rim. Nitrogen or carbonation pressure is transmitted from the beverage filler head to the inside space of the beverage container. This pressure is also fully transmitted to the receptacle outer walls. The pressure within the receptacle builds up and equilibrates with the pressure of gas inside the beverage container. The pressure outside the receptacle causes the receptacle bottom wall to deform slightly, pushing against the trapped water in the receptacle until the receptacle valve seat recess inside wall seals tightly against the sealing cone of the stem valve. This stops any water from escaping from the receptacle. Since the receptacle is now filled with only water, and water is essentially incompressible, minimal deformation of the receptacle walls occurs preventing any damage to the thin receptacle walls. The pressurization of the container with carbon-dioxide gas is important when carbonated beverage are being filled to ensure that the carbonation of the beverage occurs during the filling process. The beverage itself is usually carbonated when it enters the container, where, because of the absorption of pressurized carbon-dioxide gas, it becomes highly carbonated. For a container without the receptacle, the container column strength is obtained by the filler head firmly forming a seal with the empty open container rim and pressurizing the container directly with a blast of carbon-dioxide gas. The column strength of the container is obtained by the internal pressure of the container. This allows the filler head to firmly seal the rim of the container to

maintain the pressure of the beverage during the filling process. Thus it is important that the above steps be taken in manufacturing a useful self-cooling beverage container. Absence of water could cause the receptacle walls to collapse and prevent column strength from building up, thus causing the container to collapse under the filler head forces. Thus, during filling, the receptacle advantageously transmits the filler head forces directly to the water without subjecting the container walls or the receptacle walls to deformation stresses.

The method of manufacture of the receptacle generally involves the broad steps of injection molding preforms from suitable plastic materials; blow molding the receptacle to a shape of particular form; orienting the receptacle for filling with water; inserting the stem valve into the receptacle; and insertion the assembly into beverage containers so that the stem valve stud is pushed ti a tight fit into the container bottom wall hole; filling the beverage container with beverage; seaming the container lid onto the container rims; checking for carbonation column strength of the filled and seamed container. The steps further comprise; the broad steps of ejecting the water in the receptacle by pressure feeding a small dose of higher liquified aerosol propellants into the receptacle through the stem valve hole; said aerosol propellant opening the seal made between the valve seat recess and the sealing cone of the stem valve body; using a high pressure piston charger to charge liquified aerosol propellants through the stem valve hole into the receptacle; storing the apparatus for later sale or use by a consumer.

It is important to know that the liquified phase of the aerosol propellants or gas/carbon matrix to be used for cooling must be at a lower pressure than the beverage carbonation pressure. This is a requirement of the invention, since the beverage pressure must be able to overcome the internal pressure of the aerosol propellants inside the receptacle, to force the receptacle valve seat

recess to form a seal with the stem valve outer bottom edge. This is because as the pressure in the beverage container builds up, it compresses the receptacle walls and forces the larger surface area of the receptacle bottom wall inward into receptacle toward the stem valve bottom edge. However, since the area exposed to the aerosol propellant pressure inside the valve seat recess is smaller than the outer surface area exposed to beverage carbonation pressure by the amount of the area trapped by the receptacle valve seat recess and the stem valve outer bottom edge, and since the carbonation pressure is higher than the beverage pressure, the valve seat and stem valve sealing cone will seal off the stem valve hole from the aerosol propellants completely. If careful calculations are made, it is possible to have the aerosol propellant pressure equal or greater than the carbonation pressure by adjusting the area of exposed valve seat sealed off area. This makes it possible to use other suitable refrigerants. The difference in pressure can be estimated by the following formula:

$$P_R \leq \frac{(P_B - P_S)D^2}{(D^2 - d^2)}$$

where P_R is the maximum pressure of the aerosol propellants to be used, P_B is the pressure of the carbonated beverage, and P_s is the security difference in pressure to be used for the sealing of the aerosol propellants during storage, and D is the diameter of the bottom receptacle wall, and d is the diameter of the sealing cone of the stem valve. P_s is nominally found to be about 5 psi under normal temperature conditions in Florida. In other countries, the value of P_s will depend on the variability of the carbonation pressure and the aerosol propellant pressure with ambient conditions, particularly, temperature.

Thus by adjusting any of these parameters, the aerosol propellant pressure could be

determined for any given stem valve and receptacle dimensions and given beverage pressure. This offers a great variability in the possible types of gases that could be used for cooling the beverage, and a variety of embodiments could be used.

Since by design the carbonation pressure will always form a seal for the aerosol propellant gas in the receptacle, the removal of the trapped water in the receptacle is a little demanding. This is achieved by using a higher pressure liquid dose aerosol propellants other than the aerosol propellants to be stored in the receptacle. This small liquid dose of aerosol propellants must always produce a force that tends to open the valve seal. This can be achieved if the pressure of the liquid dose aerosol propellants $P_{D,}$

follows the relation,

$$P_D > \frac{(P_B + P_S)D^2}{\left(D^2 - d^2\right)}.$$

For example if the carbonation pressure $P_B = 50$ psi, and if $D = 1.86$, $d = .25$, with a safety pressure lock of $P_s = 5$ psi, the aerosol propellants pressure must be given by,

$$P_R \leq \frac{(50-5)1.86^2}{\left(1.86^2 - .25^2\right)} = 45.83psi$$

and the liquid dose aerosol propellant pressure required to evacuate the water from the receptacle must be greater than the value calculated by the formula,

$$P_D > \frac{(50+5)1.86^2}{\left(1.86^2 - .25^2\right)} = 56.01psi$$

however, the surface area of the stem valve hole is far smaller than the area of the receptacle bottom wall, so that the pressure required be exerted through the stem valve hole to push back the receptacle valve seat away from the stem valve sealing cone is far greater than that of the liquified aerosol propellants alone. A higher pressure aerosol propellant may be used to achieved this. It is preferable that the aerosol propellant used to practice the invention have a lower vapor pressure in the liquified state than the beverage carbonation pressure. This allows the receptacle bottom wall to always force the receptacle valve seat back into a sealing position against the sealing cone of the stem valve. Thus, if water is to be displaced from the receptacle, a liquid dose aerosol propellant with a liquid phase pressure higher than carbonation pressure may be used but not stored in the receptacle. With the liquid dose aerosol propellant pressure higher than the carbonation pressure, the liquid dose aerosol propellant is able to maintain the stem valve and the receptacle valve seat in a relatively open state until all the water and liquid dose aerosol propellant has escaped from the receptacle. Some liquid dose aerosol propellant in a gaseous form will remain in the receptacle to keep the receptacle walls from collapsing under carbonation pressure. Upon complete or almost complete removal of the water from the receptacle, the liquified aerosol propellant charge or mixture that is to be stored in the receptacle is then injected through the stem valve hole into the receptacle by a pressure assist piston pump in a liquified state into the receptacle. This has the advantage of completely filling the receptacle with liquified aerosol propellant without deforming the receptacle walls. Alternatively if a carbon matrix is used to store some aerosol propellant, then the carbon matrix is first poured into the receptacle prior to inserting the stem valve. Upon completion of the charging, carbonation pressure pushes against the receptacle bottom wall to reseal the receptacle bottom wall conical protrusion against the stem valve outer bottom edge, trapping

the liquified aerosol propellant inside the receptacle.

The completed apparatus is then stored or shipped to a customer for consumption. The process of activation involves simply opening the container lid for consumption, so that the carbonation pressure falls to atmospheric pressure, and the pressure of the liquified aerosol propellant acting on the internal walls of the receptacle becomes greater than atmospheric pressure, causing the receptacle bottom wall to push away from the stem valve outer bottom edge, and breaking the seal. Since the stem valve sealing cone is above the liquid level of the aerosol propellant , only gas is releases through the bottom of the container, when the container is upright. This also has the advantage of preventing anyone from playing with the apparatus until it is opened for consumption.

To operate the present invention for use as a self-cooling container, no additional activation means is provided that can be tampered with by a user. The beverage container opening means is opened for the container contents to be consumed. This simultaneously opens the receptacle valve and aerosol propellant mixture is progressively discharged from the receptacle, extracting heat from the container contents by means of evaporation.

A self-cooling container apparatus is further provided for retaining container contents such as food or beverages; and a container contents release mechanism for releasing the container contents from the container and also for effectuating the release of liquified gas stored in the receptacle.

A process of manufacturing the above-described self-cooling container apparatus is provided, including the steps of orienting the stem valves for insertion into the receptacles; filling the receptacles with water; inserting the stem valves into the receptacles; and inserting the

assemblies into beverage containers; filling each beverage container with beverage; pumping a high pressure liquified aerosol propellant into the receptacle to exhaust the water from the receptacle; filling the receptacle with aerosol propellant ; seaming or crimping the container lid onto the container.

For plastic bottle containers, the receptacle is integrated with the beverage bottle by a novel blow molding technic which involves the use of a dual preform that is blown in two stages. The plastic preform is designed as two concentric cylinders that are unified at the neck of the inner cylinder and the bottom of the outer cylinder of the preform. The inner part of the preform is a cylindrical vessel with a threaded open neck that is oriented with its bottom sealing wall inside the outer cylindrical part of the preform. The outer cylinder has a threaded open neck, so that the two cylindrical vessels are oriented with their open threaded necks in opposite directions. Thus, a concentric beverage chamber is formed between the walls of the projecting inner part of the preform and the outer part of the preform. The inner part of the preform is also designed with a conical valve seat as its base. Thus, the valve seat described earlier for the metal container receptacle is formed when the preform is made. The first stage of manufacturing the container is to heat and blow the outer part of the preform through the open threaded neck while maintaining a support member inside the inner part of the preform valve seat, so that the shape of the valve seat is maintained. Another support member is inserted through the open neck of the formed bottle to support the outer surface of the valve seat, so that the valve seat is trapped between the inner support member and the outer support members during molding. The valve seat of the inner cylinder of the preform is thus left intact when the bottle is formed, and when the aerosol propellant receptacle is formed by the second blowing. The mold for the outer preform is designed to take the shape of any plastic

beverage container, so that when the bottle is formed, it looks like a functional plastic beverage bottle. Thus, when the outer part of the preform is blown, a conventional bottle is formed with a receptacle projecting within it. The beverage bottle thus formed now has a projecting cylinder inside it with a threaded neck protruding from its bottom wall. The second stage of manufacture, is to heat and insert a blow pin and support member through the threaded neck of the inner cylinder part and then blowing the preform inside the bottle while supporting the valve seat of the inner part of the preform. This will cause the inner preform to substantially expand and form a paraboloid aerosol propellant receptacle that can be used to store a aerosol propellant mixture. Thus, advantageously, a beverage bottle is formed by the outer part of the preform which has a conventional unified bottom wall that is fused to the inner aerosol propellant receptacle with a threaded neck protruding from the bottom and top walls respectively. A threaded plastic cap is also provided for sealing off the beverage bottle contents. Now, the internal protruding aerosol propellant receptacle formed by the blown inner part of the preform forms a paraboloid aerosol propellant receptacle since the pressure generated by blowing will essentially impart a paraboloid shape to the cylindrical inner part of the preform. The bottle form by the larger outer cylinder of the preform has a shape that is governed by the mold that forms it. The inner aerosol propellant receptacle thus formed comprises a parabolic aerosol propellant receptacle terminating at a conical bottom valve seat. The aerosol propellant receptacle is designed to store a liquified aerosol propellant mixture at a minimal pressure difference across its walls by means of equilibration with beverage pressure of the of the outer beverage bottle when the aerosol propellant pressure acting inside the aerosol propellant receptacle walls equilibrates with beverage pressure acting outside the receptacle walls. The aerosol propellant may be designed as mixture of aerosols and scents or as a slurry of activated

carbon matrix with CO_2 gas trapped inside the slurry matrix. The aerosol propellant receptacle valve seat is flexible. The inside wall of the valve seat recess is designed to sealingly mate with the sealing cone of a substantially tubular part of a stem valve, so that liquified aerosol propellant contained inside the receptacle will not boil and escape from within the aerosol propellant receptacle when the pressure outside the aerosol propellant receptacle is greater than the pressure of the aerosol propellant gas contained inside the receptacle. Advantageously, the aerosol propellant receptacle valve seat will not form a seal with the stem valve sealing cone if the outside pressure acting on the receptacle walls is less than the liquified aerosol propellant pressure acting on inside walls of the aerosol propellant receptacle.

The apparatus further comprises a stem valve for mating with the aerosol propellant receptacle. The stem valve is a substantially tubular valve with a sealing threaded cap attached near one end of the stem valve. The aerosol propellant sealing threaded cap is made to sealing attach to the threaded neck of the aerosol propellant receptacle and at the same time it forms a base cup seat for the bottle. A short cylindrical tube of a length of about ½ inches and diameter 3/8 inch protrudes from the outer surface of the aerosol propellant sealing threaded cap and connects to a conical tube stem valve body of a length of about 3 inches. The dimensions given are only for the sake of comparative clarity of the present invention, and should not be construed as the only possible dimensions for the parts of the apparatus. A short small cylindrical stud protrudes from the inside surface of the aerosol propellant sealing threaded cap in the opposite direction to the stem valve body. The approximate diameter of the stud is about 1/4 inch, but it could be larger or smaller depending on the size of the beverage bottle the apparatus is designed for. A small stem valve hole passes through the entire length of the stem valve. The stem valve hole could be made larger inside

the stem valve body, for reasons of ease of manufacturing. However, the hole that passes through the stud must be close to 0.04 inches diameter. Again all of the dimensions sited are examples of one embodiment of the invention.

In one embodiment of the invention, the apparatus is assembled by first affixing the stem valve into the aerosol propellant receptacle by passing the stem valve body through the aerosol propellant receptacle threaded open neck, so that the aerosol propellant receptacle sealing threaded cap threads into the projecting threaded aerosol propellant receptacle neck cylinder. The stem valve cylinder is designed to fit snugly and tightly into the aerosol propellant receptacle open neck so that a gas tight plug is formed around the aerosol propellant receptacle sealing threaded open neck protrusion. The stem valve is made long enough so that when the stem valve sealing threaded cap mates with the aerosol propellant receptacle threaded open neck, the stem valve sealing cone also sealingly abuts the inside side wall of the aerosol propellant receptacle valve seat recess. Thus, when the stem valve sealing cone abuts the inside side wall of the aerosol propellant receptacle valve seat recess, pressurized gas cannot escape through the stem valve hole, or through the aerosol propellant receptacle open neck protrusion, when the pressure inside the aerosol propellant receptacle is less than the pressure outside the aerosol propellant receptacle. And when the pressure inside the aerosol propellant receptacle is greater than the pressure outside the aerosol propellant receptacle the aerosol propellant receptacle valve seat recess is expanded and moves away from the stem valve sealing cone so that pressurized gas can escape through the stem valve hole. An sealing cone is provided on the stem valve to ensure proper sealing with the valve seat. Other methods of practicing the invention do not require that the stem valve bottom edge seal the inside wall of the aerosol propellant receptacle valve seat recess when the stem valve threaded cap is fully sealingly

threaded unto the aerosol propellant receptacle threaded open neck. It is important that the stem valve sealing cone be close to or actually contact the inside surface of the aerosol propellant receptacle valve seat, so that if the pressure inside the aerosol propellant receptacle is less than the pressure outside the aerosol propellant receptacle, the aerosol propellant receptacle bottom wall is deflected inwardly to make contact between the inner surface of the aerosol propellant receptacle valve seat recess and the sealing cone of the stem valve to form a gas tight seal that traps any liquified or gaseous aerosol propellant inside the aerosol propellant receptacle from escaping to the outside through the stem valve hole.

To manufacture the apparatus, the aerosol propellant receptacle is first filled with clean water. The stem valves are then inserted into the aerosol propellant receptacle through the aerosol propellant receptacle open threaded neck to displace some water and form a seal with the aerosol propellant receptacle open threaded neck and the aerosol propellant receptacle valve seat recess inside surface. Thus the water is trapped inside the aerosol propellant receptacle and cannot pass through the stem valve hole, or the aerosol propellant receptacle open threaded neck. The assembly is then transported to a beverage filling plant, where the bottle is filled with beverage product under carbonation pressure.

During the beverage filling process, a filler head is sealed against the beverage bottle threaded neck rim. Nitrogen or carbonation pressure is transmitted from the beverage filler head to the inside space of the bottle. This pressure is also fully transmitted to the aerosol propellant receptacle outer walls. The pressure within the aerosol propellant receptacle builds up and equilibrates with the pressure of gas inside the bottle. The pressure outside the aerosol propellant receptacle causes the aerosol propellant receptacle bottom wall to deform slightly, pushing against

the trapped water in the aerosol propellant receptacle until the aerosol propellant receptacle valve seat recess inside wall seals tightly against the sealing cone of the stem valve. This stops any water from escaping from the aerosol propellant receptacle. Since the aerosol propellant receptacle is now filled with only water, and water is essentially incompressible, minimal deformation of the aerosol propellant receptacle walls occurs preventing any damage to the thin aerosol propellant receptacle walls. The pressurization of the bottle with carbon-dioxide gas is important when carbonated beverage are being filled to ensure that the carbonation of the beverage occurs during the filling process. The beverage itself is usually carbonated when it enters the bottle, where, because of the absorption of pressurized carbon-dioxide gas, it becomes highly carbonated. For a bottle without the aerosol propellant receptacle, the bottle column strength is obtained by the filler head firmly forming a seal with the empty open bottle rim and pressurizing the bottle directly with a blast of carbon-dioxide gas. Absence of water could cause the aerosol propellant receptacle walls to collapse and the aerosol propellant receptacle to collapse and damage under the filler head forces. Thus, during filling, the aerosol propellant receptacle advantageously transmits the filler head forces directly to the water without subjecting the aerosol propellant receptacle walls to deformation stresses.

The method of manufacture of the aerosol propellant receptacle generally involves the broad steps of injection molding preforms as describe above from suitable plastic materials; blow molding the aerosol propellant receptacle in two stages or in a single stage to form the bottle and aerosol propellant receptacle; orienting the bottle for filling the aerosol propellant receptacle with water; inserting the stem valve into the aerosol propellant receptacle and locking the stem valve threaded cap unto the aerosol propellant receptacle threaded neck; filling the bottle with beverage; and

capping the bottle with a threaded cap; checking for carbonation column strength of the filled bottle. The steps further comprise; the broad steps of ejecting the water in the aerosol propellant receptacle by pressure feeding a small dose of higher liquified aerosol propellant into the aerosol propellant receptacle through the stem valve hole; said aerosol propellant opening the seal made between the valve seat recess and the sealing cone of the stem valve body; using a high pressure piston charger to charge liquified aerosol propellant through the stem valve hole into the aerosol propellant receptacle; storing the apparatus for later sale or use by a consumer.

It is important to know that the liquified phase of the aerosol propellant or the aerosol propellant / carbon matrix to be used for propelling the scent and cooling the beverage must be at a lower pressure than the beverage carbonation pressure. This is a requirement of the invention, since the beverage pressure must be able to overcome the internal pressure of the aerosol propellant inside the aerosol propellant receptacle, to force the aerosol propellant receptacle valve seat recess to form a seal with the stem valve outer bottom edge. This is because as the pressure in the bottle builds up, it compresses the aerosol propellant receptacle walls and forces the larger surface area of the aerosol propellant receptacle bottom wall inward into aerosol propellant receptacle toward the stem valve bottom edge. However, since the area exposed to the aerosol propellant pressure inside the valve seat recess is smaller than the outer surface area exposed to beverage carbonation pressure by the amount of the area trapped by the aerosol propellant receptacle valve seat recess and the stem valve outer bottom edge, and since the carbonation pressure is higher than the beverage pressure, the valve seat and stem valve sealing cone will seal off the stem valve hole from the aerosol propellant completely. If careful calculations are made, it is possible to have the aerosol propellant pressure equal or greater than the carbonation pressure by adjusting the area of exposed

valve seat sealed off area. This makes it possible to use other suitable aerosol propellant s. The difference in pressure can be estimated by the following formula:

$$P_R \leq \frac{(P_B - P_S)D^2}{(D^2 - d^2)}$$

where P_R is the maximum pressure of the aerosol propellant to be used, P_B is the pressure of the carbonated beverage, and P_s is the security difference in pressure to be used for the sealing of the aerosol propellant during storage, and D is the diameter of the bottom aerosol propellant receptacle wall, and d is the diameter of the sealing cone of the stem valve. P_s is nominally found to be about 5 psi under normal temperature conditions in Florida. In other countries, the value of P_s will depend on the variability of the carbonation pressure and the aerosol propellant pressure with ambient conditions, particularly, temperature.

Thus by adjusting any of these parameters, the aerosol propellant and scent chemicals pressure could be determined for any given stem valve and aerosol propellant receptacle dimensions and given beverage pressure. This offers a great variability in the possible types of gases that could be used for cooling the beverage, and a variety of embodiments could be used.

Since by design the carbonation pressure will always form a seal for the aerosol propellant gas in the aerosol propellant receptacle, the removal of the trapped water in the aerosol propellant receptacle is a little demanding. This is achieved by using a higher pressure liquid dose aerosol propellant other than the aerosol propellant to be stored in the aerosol propellant receptacle. This small liquid dose of aerosol propellant must always produce a force that tends to open the valve seal. This can be achieved if the pressure of the liquid dose aerosol propellant P_D

follows the relation,

$$P_D > \frac{(P_B + P_S)D^2}{(D^2 - d^2)}.$$

For example if the carbonation pressure $P_B = 50$ psi, and if $D = 1.86$, $d = .25$, with a safety pressure lock of $P_s = 5$ psi, the aerosol propellant pressure must be given by,

$$P_R \leq \frac{(50 - 5)1.86^2}{(1.86^2 - .25^2)} = 45.83 psi$$

and the liquid dose aerosol propellant pressure required to evacuate the water from the aerosol propellant receptacle must be greater than the value calculated by the formula,

$$P_D > \frac{(50 + 5)1.86^2}{(1.86^2 - .25^2)} = 56.01 psi$$

however, the surface area of the stem valve hole is far smaller than the area of the aerosol propellant receptacle bottom wall, so that the pressure required be exerted through the stem valve hole to push back the aerosol propellant receptacle valve seat away from the stem valve bottom outer edge is far greater than that of the liquified aerosol propellant alone. A higher pressure aerosol propellant may be used to achieved this. It is preferable that the aerosol propellant used to practice the invention have a lower vapor pressure in the liquified state than the beverage carbonation pressure. This allows the aerosol propellant receptacle bottom wall to always force the aerosol propellant receptacle valve seat back into a sealing position against the sealing cone of the stem valve. Thus,

if water is to be displaced from the aerosol propellant receptacle, a liquid dose aerosol propellant with a liquid phase pressure higher than carbonation pressure may be used but not stored in the aerosol propellant receptacle. With the liquid dose aerosol propellant pressure higher than the carbonation pressure, the liquid dose aerosol propellant is able to maintain the stem valve and the aerosol propellant receptacle valve seat in a relatively open state until all the water and liquid dose aerosol propellant has escaped from the aerosol propellant receptacle. Some liquid dose aerosol propellant in a gaseous form will remain in the aerosol propellant receptacle to keep the aerosol propellant receptacle walls from collapsing under carbonation pressure. Upon complete or almost complete removal of the water from the aerosol propellant receptacle, the liquified aerosol propellant charge or mixture that is to be stored in the aerosol propellant receptacle is then injected through the stem valve hole into the aerosol propellant receptacle by a pressure assist piston pump in a liquified state into the aerosol propellant receptacle. This has the advantage of completely filling the aerosol propellant receptacle with liquified aerosol propellant and smell generating ingredients without deforming the aerosol propellant receptacle walls. Alternatively if a carbon matrix is used to store some aerosol propellant , then the carbon matrix is first poured into the aerosol propellant receptacle prior to inserting the stem valve. Upon completion of the charging, carbonation pressure pushes against the aerosol propellant receptacle bottom wall to reseal the aerosol propellant receptacle bottom wall conical protrusion against the stem valve outer bottom edge, trapping the liquified aerosol propellant inside the aerosol propellant receptacle.

The completed apparatus is then stored or shipped to a customer for consumption. The process of activation involves simply opening the beverage bottle cap for consumption, so that the carbonation pressure falls to atmospheric pressure, and the pressure of the liquified aerosol

propellant acting on the internal walls of the aerosol propellant receptacle becomes greater than atmospheric pressure, causing the aerosol propellant receptacle bottom wall to push away from the stem valve outer bottom edge, and breaking the seal. Since the stem valve sealing cone is above the liquid level of the aerosol propellant , only gas is releases through the bottom of the container, when the container is upright. This also has the advantage of preventing anyone from playing with the apparatus until it is opened for consumption.

To operate the present invention for use as a scented self-cooling container, no additional activation means is provided that can be tampered with by a user. The beverage container opening means is opened for the container contents to be consumed. This simultaneously opens the aerosol propellant receptacle valve and aerosol propellant mixture is progressively discharged from the aerosol propellant receptacle, extracting heat from the container contents by means of evaporation.

A self-cooling apparatus is further provided for retaining contents such as food or beverages; and contents release mechanism for releasing the contents from the bottle and also for effectuating the release of liquified aerosol propellant gas stored in the aerosol propellant receptacle.

A process of manufacturing the above-described scented self-cooling container apparatus is provided, including the steps of orienting the stem valves for insertion into the aerosol propellant receptacles; filling the aerosol propellant receptacles with water; inserting the stem valves into the aerosol propellant receptacles; and inserting the assemblies into beverage containers; filling each beverage container with beverage; pumping a high pressure liquified aerosol propellant into the aerosol propellant receptacle to exhaust the water from the aerosol propellant receptacle; filling the aerosol propellant receptacle with aerosol propellant ; seaming or crimping the container lid onto the container.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, advantages, and features of the invention will become apparent to those skilled in the art from the following discussion taken in conjunction with the following drawings, in which:

Figure 1 shows the first embodiment of the apparatus for a metal beverage container, and

Figure 2 shows the embodiment for a second version for plastic bottles..

Figure 3 shows the lid of the beverage container with an open beverage container.

Figure 4 shows the apparatus assembled with the aerosol propellant receptacle and the stem valve in potion.

Figure 5 shows one embodiment of the aerosol propellant receptacle.

Figure 6 shows the aerosol propellant receptacle valve seat protruding from the bottom wall of the aerosol propellant receptacle.

Figure 7 shows another embodiment of the aerosol propellant receptacle with a bellows type body for raising and lowering the aerosol propellant receptacle valve seat unto the stem valve outer bottom edge, but with a simple flat bottom valve seat.

Figure 8 shows the aerosol propellant receptacle of the embodiment of Figure 6 with a conical aerosol propellant receptacle valve seat.

Figure 9 shows a cut away view of the aerosol propellant receptacle with the stem valve attached therein, and the stem valve sealing cone sealing on the aerosol propellant receptacle valve seat, trapping water inside the aerosol propellant receptacle trapping water inside the aerosol propellant receptacle.